REMARKS

In the patent application, claims 1-20 are pending. In the office action, all pending claims are rejected.

Applicant has amended claims 1, 9, 14, 17 and 20. As amended, claim 1 has the limitation that the speech signals are transformed in order to obtain a spectral representation of the speech signals in the frequency domain and the spectral representation is transformed in order to obtain speech features in a cepstral domain.

The support for the amendment can be found on p. 13, line 27 to p.14, line 5. Claim 1 also includes the further limitation that the normalizing step is for providing normalized speech features having a reduced speech-to-noise ratio and the filtering step is for reducing the noise component. The support for the further amendment can be found on p.14, lines 14 - 17.

As amended, claim 9 has the limitation that the speech recognition front-end further comprises means for obtaining spectral representation of the speech signal in the frequency domain and means for extracting speech features in the cepstral domain. The support for the amendment can be found in Figure 2 (blocks 30, 40_1, ..., 40_B) and on p. 9, line 18 to p.10, line 5. As in claim 1, claim 9 also includes the limitation that the speech features are normalized in order to obtain normalized speech features having a reduced speech-to-noise ratio and that the normalized speech features in the frequency domain are for reducing the noise component.

Claims 14, 17 and 20 have been amended to include the limitation of extracting speech features in the cepstral domain and that the speech features are normalized in order to obtain normalized speech features having a reduced speech-to-noise ratio and the normalized speech features in the frequency domain is for reducing the noise component.

No new matter has been introduced.

At section 2 of the office action, claims 1, 3-10, 12, 14, 16-17 and 19 are rejected under U.S.C. 102(e) as being anticipated by *Higgins et al.* (U.S. Patent No. 6,266,633, hereafter referred to as *Higgins*). In rejecting these claims, the Examiner uses the same reasons as in the non-final office action, mailed December 13, 2004.

In the non-final office action, the Examiner stated that *Higgins* discloses a pre-processor 26 (see Figure 1) which can be used to carry out all the tasks performed by the front-end of the claimed invention. In particular, the Examiner stated that the preprocessor 26 normalizes the extracted speech features by subtracting the magnitude spectra from the noise floor and setting the negative results to zero, and filtering the normalized speech features by applying the blind deconvolution filter for reducing noise in the speech signal (col.5, lines 52-56).

It is respectfully submitted that the speech signal processing steps in *Higgins* are carried out in the frequency or spectral domain (Abstract; col. 6, lines 15 – 19; col. 6, lines 43 – 49; claim 1).

In contrast, the normalization of feature vectors of the claimed invention is carried out in a cepstral domain, as feature vectors contain cepstral coefficients. *Higgins* does not disclose or suggest normalizing speech features in the cepstral domain.

Furthermore, the front-end in the claimed invention carries out three tasks: 1) extracting speech features in the cepstral domain, 2) normalizing the extracted speech features in the cepstral domain and 3) filtering the normalized speech features in the frequency domain.

In *Higgins*, the preprocessor 26 carries out noise suppression in module 63 (Figure 2A). In particular, module 63 obtains the magnitude spectra of the spectral sequence 61 (Figure 2B) and constructs histograms of the magnitude spectra for each frequency by module 75 (col.7, lines 19-23). From the histogram, the background noise floor N_f is determined by module 80 (col.7, lines 25-33). A spectral subtractor 100 is then used to subtract the noise floor from the magnitude spectra in order to provide a noise-suppressed signal sequence 104 (col.7, lines 55-60). Finally, a blind-deconvolution (BD) filter 110 is used to reconstruct the spectral sequence 112 (col.7, line 60 to col.8, line 24). The entire process is summarized at col.9, lines 30-46. All these steps are carried out the spectral or frequency domain.

Higgins does not disclose or even suggest the steps of normalizing speech features in the cepstral domain and filtering the normalized speech features in the frequency domain. At col. 5, lines 54-60, *Higgins* discloses that a blind deconvolution filter having

a frequency response with a gain constant G is applied to the noise-floor subtracted magnitude spectra. G is used for the purpose of output level normalization. *Higgins* does not disclose normalizing the speech features in the cepstral domain and filtering the normalized speech features in the frequency domain as claimed.

Furthermore, the normalization process in the claimed invention is used to increase the power of the high frequency components so that these high-frequency components can be effectively reduced by low-pass filtering. The normalization process of the claimed invention is carried out before noise reduction. Noise reduction is carried out in a subsequent filtering process. *Higgins* subtracts the noise floor from the magnitude spectra before the blind deconvolution is carried out. The blind deconvolution filter is only used to reconstruct the spectral data sequence from the spectral subtraction (SS)-processed magnitude. This filter is different from the filter for reducing the noise component of the claimed invention.

For the above reasons, claims 1, 9, 14 and 17 are clearly distinguishable over the cited *Higgins* reference.

As for 3-8, 10, 12, 16 and 19, they are dependent from claims 1, 9, 14 and 17 and recite features not recited in claims 1, 9, 14 and 17. For reasons regarding claims 1, 9, 14 and 17 above, it is respectfully submitted that claims 3-8, 10, 12, 16 and 19 are also distinguishable over the cited *Higgins* reference.

At section 3, claims 2, 11, 15 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Higgins* in view of *Hermansky* (RASTRA processing of Speech, IEEE Trans. Speech and Audio Proc., vol.2, no.4, October 1994, pp. 578-589). However, claims 2, 11, 15 and 18 are dependent from claims 1, 9, 14 and 17 and recite features not recited in claims 1, 9, 14 and 17. For the same reasons, claims 2, 11, 15 and 18 are also distinguishable over *Higgins* in view of *Hermansky*.

At section 4, claims 13 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over *Higgins* in view of ETSI ES 201 108 V1.1.2.

As amended, claim 20 includes the limitation of extracting speech features in the cepstral domain and that the speech features are normalized in order to obtain normalized speech features having a reduced speech-to-noise ratio and the normalized speech features in the frequency domain is for reducing the noise component.

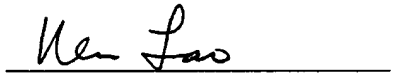
For the above reasons, claim 20 is distinguishable over *Higgins* in view of ETSI ES 201 108 V1.1.2.

As for claim 13, it is dependent from claim 9 and recites features not recited in claim 9. For reasons regarding claim 9 above, claim 13 is also distinguishable over *Higgins* in view of ETSI ES 201 108 V1.1.2.

CONCLUSION

As amended, claims 1-20 are allowable. Early allowance of all pending claims is earnestly solicited.

Respectfully submitted,



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